REMARKS

Claims 1-16 were examined in the Office Action mailed February 25, 2009.

The following objections and rejections are currently pending:

- Objection to the Abstract for use of "means" language.

- Objection to claim 9 for use of the phrase "a displacement control signal" in view of the use of the same phrase in claim 8.

- Rejection of claims 12-14 under 35 U.S.C. § 101 as non-statutory subject matter, in the ground that these claims only a program, as there is no disclosure of a "computer-readable computer program product" in the original disclosure.

- Rejection of claim 2 under 35 U.S.C. § 102(e) as anticipated by U.S. Paten No. 5,553,481 to Arai ("Arai").

- Rejection of claims 3-4 under 35 U.S.C. § 102(b) as anticipated by U.S. Patent No. 6,192,299 to Kubota, *et al.* ("Kubota").

- Rejection of claims 2, 8, 13 and 16 under § 102(b) as anticipated by U.S. Patent No. 6,101,456 to Kowatari, *et al.* ("Kowatari").

- Rejection of claims 1 and 12 under 35 U.S.C. § 103(a) as unpatentable over Kowatari, in view of U.S. Patent No. 6,671,641 to Collins, *et al.* ("Collins").

- Rejection of claims 4, 6-7 and 11 under § 103(a) as unpatentable over Kowatari, in view of Arai.

- Rejection of claim 5 under § 103(a) as unpatentable over Kowatari and Arai, further in view of Kubota.

- Rejection of claim 9 under § 103(a) as unpatentable over Kowatari, in view of Kubota.

- Rejection of claim 10 under § 103(a) as unpatentable over Kowatari and Arai, further in view of U.S. Patent No. 5,832,730 to Mizui ("Mizui").

- Rejection of claim 13 under § 103(a) as unpatentable over Arai.

- Rejection of claim 15 under § 103(a) as unpatentable over Kowatari, in view of Mizui.

The Applicants have carefully considered the February 25, 2009 Office Action, and have substantially revised the claims, canceling claims 1-16 without prejudice to the subject matter therein, and adding new claims 17-24. The new claims either address or render moot the claim objection and § 101 rejection. In addition, the Applicants have amended the Abstract to remove the objected-to "means" language.

In the displacement control method in new claim 17, there are the steps of (i) calculating a displacement control signal for driving a proportional electromagnetic valve, based on a displacement command, and (ii) adjusting a displacement angle of a hydraulic device by driving the proportional electromagnetic valve with the displacement control signal calculated in the calculating step, applying a displacement control pressure generated from the proportional electromagnetic valve to a displacement adjusting device.

In the calculating step, the displacement control signal is calculated based on the required displacement control pressure (the required pressure being based on the reference characteristic[1]), more specifically by:

(i) calculating two pressures based on the reference characteristic: a minimum-side displacement control pressure (using the reference label identified in the original disclosure, P01) corresponding to a minimum-side displacement control signal (i01) required to achieve a minimum-side

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[1] The reference characteristic is defined in the original disclosure as representing a relationship between a displacement control pressure required to provide a displacement angle corresponding to a displacement command, and a displacement control signal required for the proportional electromagnetic valve to generate the required displacement control pressure. *See, e.g.*, Fig. 10.

displacement, and a maximum-side displacement control pressure (P02) corresponding to a maximum-side displacement control signal (i02) required to achieve a maximum-side displacement,

(ii) detecting pressure generated by the proportional electromagnetic valve when the proportional electromagnetic valve is driven with minimum-side displacement control signal (i01) (thereby generating a first measured pressure), and driven with the maximum-side displacement control signal (i02) (thereby generating a second measured pressure),

(iii) calculating a first difference (ΔP01) between the minimum-side displacement control pressure (P01) and the first measured pressure, and a second difference (ΔP02) between the maximum-side displacement control pressure and the second measured pressure (the differences being referred to as "learned values"),

(iv) subsequently, in response to a displacement command, calculating a correction amount (ΔP03; *see, e.g.*, Fig. 11) based on the first and second differences (ΔP01, ΔP02) and the displacement command,

(v) correcting a required displacement control pressure required to provide a displacement angle corresponding to the displacement command with the correction amount, and

(vi) calculating the displacement control signal based on the *corrected* required displacement control pressure (the corrected pressure value then being applied in the adjusting step).

As noted in the original Specification, the present invention thus provides a highly accurate displacement control system for apparatus such as construction equipment which relies only on pressure measurement, eliminating the need for costly and potentially troublesome displacement sensors.

The Arai Reference. The Arai reference discloses an injection molding system in which hydraulic pressure is used to maintain a desired pressure in the material being injected into a mold (*i.e.*, the hydraulic pressures in ram chambers 2f and 2r are controlled to achieve a desired pressure in the injected material at cylinder 11's nozzle tip 12). Arai discloses that during the period when it would be expected that there is no pressure in chambers 2f, 2r, the pressure sensors are read, and whatever pressures are recorded are subsequently subtracted from (or added to, as appropriate) the next commanded ram pressure. Essentially, Arai views any pressure reading during system downtime as an error which is simply added to the next pressure demand to eliminate the non-zero sensor offset.

In contrast to new claim 17, Arai does not disclose or suggest at least the features of

– *displacement* control. Arai discloses *only* a *pressure* control system: while the Arai injection molding system includes a screw drive which transports injection material from hopper 13 to nozzle 12, the injection pressure control ram provides no control of displacement whatsoever, *i.e.*, the ram control is entirely independent of however the feed screw is being rotated to advance injection material toward the nozzle. The ram's *sole* purpose is to apply and maintain a

desired level of *pressure* at nozzle tip 12; there is simply no control based on the displacement of the screw, as the Arai ram maintains the pressure in the injected material whether the screw moves 1 mm or 1 meter.

— displacement control *based on the recited reference characteristics*, including predetermined relationships between *displacement* and pressure. Arai teaches only identification of instrumentation error when its hydraulic system is essentially shutdown, without an reference to any displacement relationship.

— displacement control in which a learning process provides values representative of displacement vs. pressure errors at minimum and maximum values, and use of such error values ("learned values") to subsequently derive a *new* correction value for each *newly-commanded* operating point (rather than Arai's merely subtracting a fixed pressure sensor offset, regardless of the commanded ram pressure).

For at least the foregoing reasons, Arai does not disclose or suggest the invention recited in new claim 17 (nor similarly, new claims 18-24).

The Kubota Reference. In short, Kubota discloses nothing more than a means to obtain a reference characteristic relationship.

Kubota (like Arai, directed to an injection molding machine in which injection pressure is controlled by a hydraulic ram, independent of the screw feed of material to the injection nozzle tip) teaches continuously monitoring pressure in a hydraulic circuit and constructing a reference characteristic curve by associating a particular load current required to obtain a particular hydraulic pressure with that pressure (the association criteria being the identification of

the load current at a point in time when the pressure has stabilized). Kubota Abstract ("the pressure is assumed to be stabilized at a point of time when a difference ΔP between the measured pressure value and the previously measured pressure value becomes a predetermined level or less, and the measured pressure value at this point of time is employed as a pressure corresponding to a load current at this step"). Kubota discloses little else of relevance to the invention claimed in claims 17-24, and therefore does not disclose or suggest a number of the features of the claimed invention.

The Kowatari Reference. This reference discloses an output correction method which ultimately applies a correction a command signal, but proceeds to do so in a manner which is fundamentally different from the invention recited in new claims 17-24. Kowatari teaches an application of a "reverse characteristic having a reverse input/output relationship to a target input/output characteristic" which is preset, and then a target value for an output of the control object is calculated. Kowatari Abstract. As recited in claim 17 (claims 18-24, similar), pressure measurements at minimum and maximum points associated with a displacement vs. pressure characteristic are used to develop learned values, which are then in turn used to develop actual operating parameter corrections during displacement control operations. This approach to displacement control is neither disclosed or suggested by Kowatari.

Because none of Arai, Kubota or Kowatari disclose or suggest the invention recited in new claims 17-24, and their deficiencies are not cured by the remaining cited references, these claims are patentable over these references.
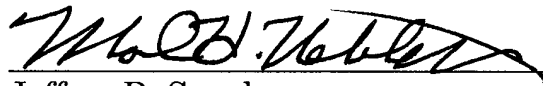
CONCLUSION

In view of the foregoing amendments and remarks, the Applicants submit that new claims 17-24 are patentable over the cited references, and are in condition for allowance. Early and favorable consideration, and issuance of a Notice of Allowance for these claims, is respectfully requested.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

If necessary to effect a timely response, this paper should be considered as a petition for an Extension of Time sufficient to effect a timely response, and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 05-1323 (Docket # 101790.58258US).

Respectfully submitted,

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